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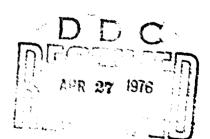
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NSWC/DL TR-3416

EVALUATION OF A STEEL CARTRIDGE CASE FOR USE WITH 76MM/62 CALIBER AMMUNITION

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October 1975



FOREWORD

This project was a continuation of work performed for the Technical Evaluation (TECHEVAL) of 76mm/62 Caliber ammunition. It was funded under NAVORD ORDTASK 55/065/090/4 Amendment A of 27 July 1973. This report was reviewed by Messrs J. A. Nunziato and R. Shank of the Technical Evaluation Department.

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ABSTRACT

A series of tests were performed to evaluate the suitability of a steel cartridge case as a replacement to the brass cartridge case used in the 76mm/62 Caliber family of ammunition. The scope of the test program conducted was limited to cartridge case integrity at service and proof conditions, and compatibility with the 76mm MARK 75 gun mount. Tests performed included cartridge case integrity and compatibility tests in the MARK 75 gun mount, and structural over ests (proof firings) in a single fire mount. One cartridge case out of 205 cases tested was found to have failed structurally upon firing. After examination of the cartridge case by the Naval Ordnance Station/Indian Head, Maryland, it was determined that the cause of the failure was the presence of a manufacturing defect in the case wall. As a result of the test program and analysis conducted, it is concluded that the steel cartridge case is a suitable replacement for the 76mm brass cartridge with respect to structural integrity and compatibility with the MARK 75 gun mount.

TABLE OF CONTENTS

		111		٠.		, 0.1		,,,,												F	age
FOREWOR	D	•		•		•	•	•	•		•	•	•	•	•	•	•	•	•		i
ABSTRAC	т	•		•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	ii
INTRODU	CTION			•		•	•	•			•		•		•		•	•	•	•	1
ITEM DE	SCRIPTION	•		•			•	•	•		•	•	•			•		•	•	•	2
TEST DE	SCRIPTION			•	•	•			•		•	•	•			•		•		•	4
RESULTS		•		•		•	•	•			•	•	•			•	•		•	•	6
APPENDI	CES																				
Α.	MOUNT COMPATIBILY	TY	TES	Т	•	•			•	•	•		•	•	•		•	•			A-1
В.	SINGLE FIRE PROOF	TE	ST			•	•								•	•	•	•			B-1
С.	SINGLE FIRE SERVI	CE	TES	Т			•	•			•										C-1
D,	RAPID FIRE SERVIC	E I	EST	•						•	•					•		•	•		D-1
Ε.	REFERENCES							•				•									E-1
F.	DISTRIBUTION													_							F-1

LIST OF TABLES

- B-1. Single Fire Proof Test; Summary of Results
- B-2. Single Fire Proof Test
- C-1. Single Fire Service Test
- D-1. Rapid Fire Service Test

LIST OF FIGURES

- 1. Drawing of 76mm/62 Caliber Steel Cartridge Case
- C-1. 76mm/62 Caliber Velocity vs. Temperature for Brass and Steel Cartridge Cases
- C-2. 76mm/62 Caliber Pressure vs. Temperature for Brass and Steel Cartridge Cases
- D-1. View of Longitudinal Split in Steel Cartridge Case
- D-2. 76mm/62 Caliber Rapid Fire vs. Target Board

INTRODUCTION

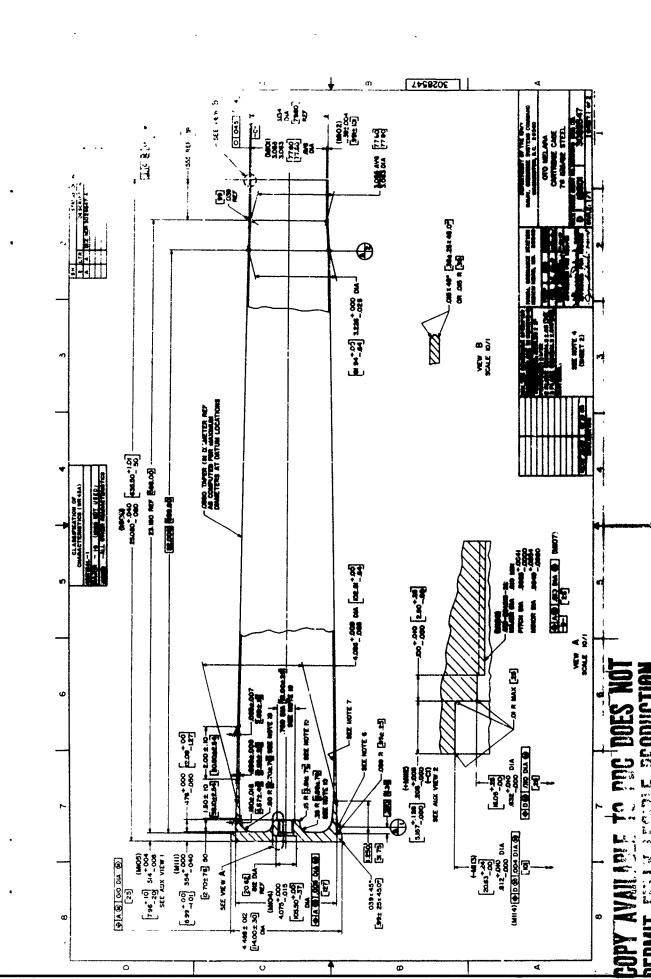
The U.S. Navy secured manufacturing rights to the 76mm/62 Caliber OTO Melara automatic mount as a result of its favorable showing in a survey of the European ordnance field. Original prototype mounts purchased were subjected to a technical evaluation at the Naval Surface Weapons Center/Dahlgren Laboratory (references 1 and 2). Both versions of the 76mm mount evaluated, designated the MARK 75 MODs 0 and 1, essentially met baseline requirements established beforehand.

Fuzes used on Italian-manufactured ammunition were considered unsuitable for U.S. use; consequently, a program was required to manufacture suitable ammunition in the U.S.. Because of time constraints, it was decided to copy the basic Italian cartridge design. A 76mm ammunition program was implemented to provide (a) design documentation of Italian ammunition to allow U.S. manufacture, (b) an engineering evaluation of U.S. manufactured ammunition to ensure comparibility with Italian ammunition, and (c) a technical evaluation of the U.S.-manufactured ammunition to determine overall performance, safety, reliability and producibility. Several changes to the original Italian ammunition design were made before these evaluations took place. Among them were minor changes to enhance producibility, use of new types (and shapes) of fuzes, the development of smoke-puff round, and the evaluation of a steel cartridge case as a substitute for the brass cartridge case used by the Italians.

Several tests were performed with the steel cartridge case during the 76mm Engineering Evaluation (reference 6), however, a malfunction in the mount/ammunition system in which a steel cartridge case was used forced postponement of the steel case evaluation. Reference 7 suggested that use of the steel cartridge case did not contribute to the malfunction. The remaining steel cartridge case tests were rescheduled. This report documents the subsequent tests.

ITEM DESCRIPTION

Figure 1 shows a drawing of the 76mm steel cartridge case (NAVORD Dwg. No. 3028547). It is manufactured from steel conforming to MIL-S-3289. Each cartridge case was loaded with a MARK 161 percussion primer and with a propelling charge of M6/2 propellant from lot RAD-E33. Probing rounds were fired during the tests to determine approximate charge weights necessary to achieve specific test conditions of service and nominal proof pressures at various temperatures. Complete cartridge loading was completed in accordance with procedures established during the brasscased ammunition program, i.e., a 1-inch thick polyethylene wad was glued on top of the propellant bed (3M Company 1099 adhesive used as a weather seal), a triangular cardboard spacer was installed, 30 grams of lead foil was placed in the cavity to act as a decoppering agent upon firing, and an inert 76mm BL&P projectile was loaded and crimped (125 tons crimping force).



Schematic of 76mm/62 Caliber steel cartridge case.

FIGURE 1

TEST DESCRIPTION

Tests performed in the evaluation of the steel cartridge case were as follows:

- a. Mount Compatibility Test: Ten inert-loaded cartridges with fired primer and inert 5"/38 Caliber propellant were subjected to an ammunition system handling test in the MARK 75 gun mount. This involved cycling the cartridges 5 times through the handling system of the mount, and ramming the cartridges on the fifth cycle. Integrity of the cartridge case and crimp were evaluated after each cycle, and debulleting of the projectiles from the steel cases was verified.
- b. Single Fire Proof Test: Fifteen cartridges were fired from a single fire mount as probing rounds to establish charge weights under service and proof conditions. Thirty cartridges were fired from a single fire mount with propelling charges adjusted to give proof pressure (19.5 to 21.0 long tons/in² nominal, in accordance with WS 14795A), ten cartridges at each of three conditioning temperatures (20°F, 90°F, and 120°F). The integrity of the cartridge cases under overtest or proof conditions was determined.
- c. Single Fire Service Test: Sixty cartridges loaded to service charge were fired from the MARK 75 mount (single fire), thirty each conditioned to $20^{\rm o}$ F and $120^{\rm o}$ F. Compatibility of the cartridge case with the MARK 75 mount at various temperatures was determined.
- d. Rapid Fire Service Test: Five 20-round bursts (service charge) were fired from the MARK 75 mount, one burst through a vertical target located 500 yards from the muzzle, and four bursts at a quadrant elevation of 15°. Phototriangulation techniques were used on the last four bursts to obtain range and deflection information as additional data for use in assessing the accuracy potential of the MARK 75 mount (accuracy data are included in this report but are discussed in detail in reference 8). Structural integrity of the cartridge case and compatibility with the MARK 75 mount in the rapid fire mode were determined.

The overall objectives of these four tests were to determine the suitability of the steel cartridge case as a replacement for the standard brass cartridge case now in use by assessing its performance in, and compatibility with, the MARK 75 gun mount. Complete descriptions of these tests are given in Appendices (A) through (D).

RESULTS

Complete details on test results are given in Appendices (A) through (D). The results are summarized below:

- a. The steel cartridge case will withstand handling, ramming, firing, and extractions in the MARK 75 gun mount (160 successes out of 160 attempts).
- b. The steel cartridge case retains its structural integrity when subjected to proof pressures.
- c. Extraction forces measured for the steel cartridge case are generally lower than those measured for the brass cartridge case.
- d. The approximate service charge weight of 5.30 lb. of 1ot RAD-E33 propellant produced acceptable average chamber pressures (17.7 long tsi).

Based on the above results, it is concluded that the steel cartridge case is a suitable replacement for the 76mm brass cartridge case with respect to structural integrity and compatibility with the MARK 75 gun mount.

It is noted that to fully qualify the steel cartridge case for service use, an assessment of the effects of environmental conditioning during its logistic cycle is needed. It is not anticipated that an extensive evaluation would be required since the construction of the 76mm steel cartridge case is similar to other existing steel cartridge cases.

APPENDIX A

STEEL CARTRIDGE CASE EVALUATION

Mount Compatibility Test

Objective: Determine if 76mm steel cartridge cases can withstand cycling and ramming in the MARK 75 gun mount.

Test Description: Ten inert 76mm cartridges were prepared by loading steel cartridge cases with fired MARK 161 primers and 5.35 lbs of 5"38 Caliber inert propellant.* An inert BL&P projectile was installed and crimped with 125 tons crimping pressure. The cartridges were individually loaded into the revolving magazine of the MARK 75 gun mount and cycled through the ammunition handling system with each cartridge being removed just before the ramming process of the gun mount. Each cartridge was cycled through the handling system a total of 5 times. On the fifth cycle, the gun mount was allowed to complete its loading cycle, i.e., the automatic rammer placed the cartridge in the chamber of the gun barrel liner causing the projectile to debullet as it does under normal conditions in the 76mm gun system. After extraction of the rammed cartridge case, the seated projectile was removed with a rod pushed down the muzzle end of the barrel.

Deviations: No deviations were made from the test plan of reference (9).

Results: All cartridge cases were structurally sound after five cycles and a final ram. All crimps were tight after three cycles through the handling system. After the fourth cycle, six of the ten cartridges had loosened crimps and the projectiles could be rotated in the crimp, however, based on the previous experience on the MARK 75 mount with brass cased ammunition, none were loose enough to cause any problems when going through the ammunition handling system. After the last cycle, in which all cartridges were rammed in the mount, test cartridges 2 through 10 were observed to have debulleted after ramming. It is likely that the first cartridge also debulleted, but the evidence was destroyed when the projectile was inadvertently pushed back into the case before the case was extracted. Debulleting therefore was verified on 9 of 10 units.

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^{*}See NAVORD Dwg. 3028548 for loading details.

Conclusion: 76mm/62 Caliber steel-cased cartridges can successfully withstand the ammunition handling environment of the MARK 75 gun mount.

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APPENDIX B

STEEL CARTRIDGE CASE EVALUATION

Single Fire Proof Test

Objective: Determine the ability of the steel cartridge case to withstand higher than normal chamber pressure (proof pressures) at various temperatures.

Test Description: Since a propelling charge weight determination had not been made to estimate the charge weight necessary for either service or proof pressures, several probing rounds were fired at various charge weights to establish charge weight/chamber pressure relationships. The purpose of the test was to assess the strength of the cartridge case at various temperatures, so charge weights were estimated that would achieve cartridge case proof pressures (nominally 19.5 to 21.0 long tons/in2 (copper) in accordance with WS 14795) at 20° F, 90° F, and 120° F. At the same time, the charge weight to achieve service velocity and chamber pressure were estimated (3000 ± 10 ft/sec, 17 to 19 lon tons/in² at a temperature of 90° F). RAD-E33 M6/2 propellant was used in all instances. Once a charge weight was established, ten cartridges each were loaded with the proper propelling charge weight to achieve nominal proof pressures. The cartridges consisted of a steel cartridge case, a MARK 161 percussion primer, the proper charge weight of RAD-E33 propellant, and an inert BL&P projectile. Preconditioned components (except projectiles which were at ambient temperature) were used in all instances, and upon loading, each cartridge was placed back in the proper temperature conditioning chamber for stabilization. Copper crusher gauges were placed in all cartridges, two 10 and two 15-ton gauges in each probing cartridge, and three 15-ton gauges in each test cartridge. As each test cartridge was fired from a single fire mount, maximum chamber pressure and projectile velocity were measured and recorded. At the completion of the test, certain premeasured cartridge cases were rechambered as a check for fit and then returned to NOS/IH for analysis.

Deviations: There were no deviations from reference 9 on this test.

Results: All data are summarized in Table B-1 and shown in detail in Table B-2. Service and proof charges of RAD-E33 in the 76mm/62 Caliber steel cartridge case with U.S. projectiles were determined to be (velocities and pressures were obtained from data cartridges):

		Charge	Average				
	Temperature (OF)	Weight (1bs)	Velocity (ft/sec)	Pressure long tsi (Cu)			
Service	90	5.30	3900	17.2			
	20	6.10	3250	20.8			
	90	5.80	3229	21.1			
	120	5.71	3207	20.9			

All steel cartridge cases performed satisfactorily, with no case failures occurring. Most cases were hard to extract from the single fire mount but this is attributed to normal case expansion during proof firings. The range in chamber pressure at a specific charge weight in most instances was less than 2 tsi (Cu) normally experienced with the brass cartridge case. The largest variation was at 120°F, with pressures ranging from a high of 21.4 to a low of 20.3 tsi at a charge weight of 5.71 lbs. (using the 15 tsi gauge readings as the standard). Projectile velocities are nominally 3225 ft/sec., typical of previous results in 76mm tests at a similar pressure level (TECHEVAL test TS-2, fired at proof pressure at ambient temperature had a nominal chamber pressure of 21.2 tsi and an average velocity of 3204 ft/sec. with a standard deviation of 8.4 ft/sec.). It is noted that because of the lower than expected variations in chamber pressure, small adjustments in charge weight were made during the course of firings in attempts to achieve pressures slightly closer to nominal proof (21.0 tsi). Great care was exercised when doing this because the proper combination of charge weight and temperature can sometimes cause large jumps in pressure for small charge weight increases. Indeed, this did occur in one instance, when an increase of 0.3 lbs. in charge weight (at 20°F) produced a jump in chamber pressure of almost 4 tsi, to 23.7 tsi when only a 1 to 1.5 tsi increase was to be expected. Fortunately the steel cartridge case handled even this extreme overtest with no problems other than indications of a slightly deeper than normal "pressure ring" on the back of the case. This ring is merely an impression of the breechblock on the base of the case due to high pressures and is to be expected on all cartridge cases fired.

<u>Conclusion</u>: 76mm/62 Caliber steel-cased ammunition can successfully withstand chamber pressures up to proof pressures and beyond, with no ill effects.

TABLE B-1

76MM STEEL CARTRIDGE CASE EVALUATION

Single Fire Proof Test

Summary of Results

	Velocity (ft/sec) Standard	Deviation	14.4	1	4.4	5.8	7.5
	Velocit	Mean	3253	1 1 1	3212	3229	3207
(Copper))	I Gauge Standard	Deviation	0.17	20.8 0.28	0.32	0.17	20.9 0.33
ons/in2	15 TS	Mean	20.0	20.8	21.2	21.1	20.9
(Long T							
r Pressures	10 TSI Gauge 15 TSI Gauge Standard Standard	Deviation	0.15	96.0	0.12	0.04	0.33
Chambe	10 T	Mean	20.1	20.2	20.6	20.8	20.8
	Charge Weight	(1bs)	00.9	6.10	5.78	5.80	5.71
	Test Temperature	(OF)	26		06		120

TABLE B-2
76MM STEEL C RTRIDGE CASE EVALUATION

Single Fire Proof Test

Propellant: Lot RAD-133. Mount: Single fire. Barrel No.: NOSL Liner 1.

	Test Unit	Case Serial	Projectile Serial	Conditioning Temperature	Charge Weight	Average 10 151	Pressure 15 TSI	Velocity	
Date	No.	No.	No.	(°F)	(lbs)	Gauge	Gauge	(ft/sec)	Remarks
05/21/75			•••	90	5.27			3169	Italian warming round.
,,		22		90	5.35	17.4		3025	Probing round.
		91		90	5.40	18.0		3049	Probing round.
		179		90	5.50	18.7		3079	Probing round.
		34		90	5,50	18.7		3077	Probing round.
		183		90	5.65	20.2	19.5	3155	Probing round.
		6	•••	90	5,70	20.5	19.4	3180	Probing round.
•		132		90	5.75	20.4	21.2	3202	Probing round.
05/22/75				75	5.27			3149	Italian warming round.
		123		90	5.30	17.2		3000	Probing round.
		113		90	5.50	18.7		3086	Probing round.
		122		90	5.60	19.2		3134	Probing round.
		25		90	5.70	20.0	19.4	3184	Probing round.
		16		90	5.75		20,3	3207	Probing round.
		176		90	5.78		21.2	214د	Probing round.
		11		120	5.70		20.7	3199	Probing round.
		181		20	5,90	20.1	20.5	3209	Probing round.
	CS-56	174		90	5.78	20.6	21.7	3212	
	57	127	***	90	5.78	20.5	21.3	3209	
	6 6	46	-	120	5.71	20.3	21.0	3205	
	67	106		120	5.71	20.6	20.3	3200	
	76	116	***	20	6.00	20.3	20.6	3263	
	77	71	**-	20	6.00	19.9	20.1	3264	
05/23/75			•••	90	5.27			3165	Italian warming round.
		164		90	5,60	18.9	18.6	3218	Near proof round.
	CS-58	63		90	5.78	20.6	20.9	3220	•
	59	39		90	5.78	20.5	21.1.	3210	
	60	85	***	90	5.78	20.8	20.8	3208	
	61	180		90	5.80	20.8	21.1	3219 '	
	62	162		90	5.00	20.0	21.1	3229	
	63	157	***	90	5.80	20.9	20. 9	3232	
	64	153		90	5.80	20.8	20.9	3230	
	65	14	~ ~ ~	90	5.80	20.8	21.3	3234	
	68	114	***	120	5.71	21.1	20,6	3222	
	69	167		120	5.71	20.9	20.5		Case hard to load.
				90	5,27			3201	Relieving round.
06/04/75	• •			90	5.27			3167	Italian warming round.
		68		90 .	5.70		20.4	3178	Near proof round.
	CS-70	21		120	5.71	21.0	21.4	3217	
	71	10	•	120	5.71		21.2	3201	
	72	18	•••	120	5.71		21.0	3203	
	73	13	•••	120	5.71		20.8	3203	
	74	7	•••	120	5.71	****	20.9	3206	
	75	S		120	5.71		21.0	3208	
	78	124		20	6.00	20.1	19.9	3260	
	79	109		20	6.00	20.1	20.0	3248	
	80	33		20	6.00	20.2	19.9	3230	
0/ /20/20	81	97		20	6.30		23.7	3406	Baddonto 4
06/30/75				90	5.2	20.6	20.	3153	Relieving round.
	82	95		20	6.10	20.6	20.8		Fired from Liner FCA-078.
	83	Sf 5 \		20	6.10	10.8	20.6		Fired from Liner FCA-078.
	84 85	5.9	***	20 20	6.10	20.6	21.2		Fired from Liner FCA-078.
	63	ა0	•••	20	6.10	20.9	20.6		Fired from Liner FCA-078.

APPENDIX C

76MM STEEL CARTRIDGE CASE EVALUATION

Single Fire (Service Pressure) Test

Objective: Determine the compatibility of the steel cartridge case with the MARK 75 gun mount when fired at various temperatures in the single fire mode.

Test Description: Sixty steel cartridge cases were loaded with 5.30 1bs of M6/2 76mm propellant from Lot RAD-E33. BL&P cartridges were assembled in accordance with NWL Dwg. 40997 using inert projectiles. This charge weight was previously estimated (from Appendix B) to provide service velocity and pressure {3000 + 10 ft/sec, s = 15 ft/sec; 17 to 19 tsi (Cu), $\hat{s} = .60$ tsi) when fired at standard temperature (90°F) and using steel cartridge cases. Copper crusher gauges in gauge holders were placed in each cartridge case to provide an indication of chamber pressures after each shot. Thirty cartridges each were preconditioned to temperatures of 20° and 120°F. As each individual cartridge was removed from conditioning, it was placed in the lower loading drum of a MARK 75 MOD 0 gun mount, cycled through the handling system, rammed, and fired. The gun mount was instrumented to measure left and right cartridge case extraction forces, and projectile ejection time. Coils along the line of fire were used to measure projectile velocity. Chamber pressures were measured using three 15-ton copper crusher gauges in each cartridge case.

Deviations: Two deviations occurred from the test plan of reference 9. First, facilities were not available at the time of the test to precondition the test cartridges to 130°F. After consultation with the Design Agent for the steel cartridge case (NOS/III), the temperature requirement was lowered to 120°F. Secondly, reference 9 required that ten cartridges loaded to achieve proof pressure be fired from the MARK 75 mount. NAVSEA's policy throughout the 76mm Ammunition Technical Evaluation (TECHEVAL) was that no proof firings were to be conducted from the MARK 75 mount so this requirement was deleted.

Test Results: An initial attempt was made to conduct this test using a worn Italian barrel liner (FCA-064) in order to accumulate enough wear on this liner to perform one of the last brass case TECHEVAL tests. It was found, however, that wear on this liner was sufficient to produce chamber pressures far below service pressure, even when fired at high temperatures.

This was verified by firing a brass-cased cartridge, conditioned to 90° F, and observing a chamber pressure of 15.5 tsi vice 17 to 19 (see Table C-1 for tabulation of the data).

Italian liner FCA-100 (four previous cartridges fired) was substituted and most of the remainder of the cartridges fired. Two additional liner changes were made, with the last 23 cartridges being fired from either NOSL Liner 7 (four previous cartridges fired) or 8 (ten previous cartridges fired). Following is a summary of the ballistic data for these three liners:

Conditioning Temperature (°F0	Liner No.	Ve	verage elocity ft/sec)	Standard Deviation (ft/sec)	Average Pressure (Long tsi)	Standard Deviation (Long tsi)
20	FCA-100		2923	9.9	16.1	0.2
	NOSL No.	7	2912	8.1	15.4	0.3
	NOSL No.	8	2953	8.5	16.4	0.4
120	FCA-100		3008	9.6	18.5	0.3

A liner-to-liner comparison of the data at 20°F shows that there is a statistically significant (t test at 0.01 confidence level) difference in ballistic performance either in velocity or pressure, that prevents pooling the data. Several factors can contribute to the observed variations in ballistic performance including performance differences between Italian and American 76mm liners (documented in reference 10), and day-to-day variations in performance that can occur even when all other conditions are identical.

A comparison of the data with velocity/temperature and velocity/ pressure curves generated during the 76mm brass-cased ammunition TECHEVAL shows steel-cased ammunition to be slightly less affected by temperature than the brass-cased ammunition (see Figures C-1 and C-2). From the limited data available, a correction factor of approximately 0.80 ft/sec/oF for velocity and 0.025 long tsi/oF for chamber pressure was obtained. Using these values, velocity and pressure corrected to a standard of 90°F became:

Conditioning Temperature (OF)	Barrel Liner	Corrected Velocity to 90°F (ft/sec)	Corrected Pressure to 90°F (Long tsi)
20	FCA-100	2979	17.9
	NOSL No. 7	2968	17.2
	NOSL No. 8	3009	18.2
120	FCA-100	2984	17.8

Average corrected velocity for the three liners with the estimated charge weight of 5.30 lbs. of Lot RAD-E33 is slightly lower than nominal service velocity (3000 \pm 10 ft/sec). Each given liner performs consistently with the steel case since standard deviations are all less than 10 ft/sec.. Pressures are all within nominal service limits.

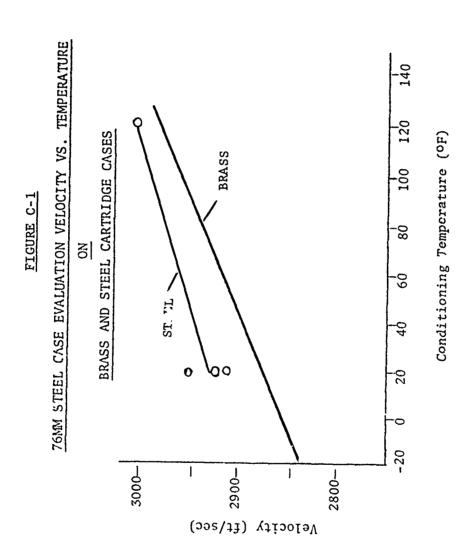
Each cartridge case was examined for damage after firing. No damage to any cartridge case was found. Extraction forces were measured to determine the compatibility of the cartridge case with the gun mount, i.e., is the case harder to extract than a brass case, a condition that can cause fatigue of the extractor mechanism. Average extraction forces were:

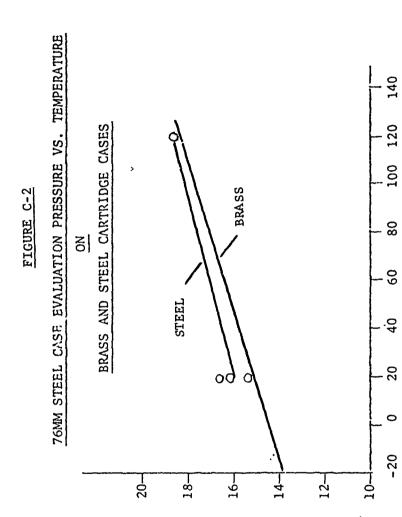
	Extraction Forces (lbs)							
Conditioning	Lef		Right					
Temperature		Standard	rd St					
(⁰ F)	Average	Deviation	Average	Deviation				
20	1993	741	2012	750				
120	2421	846	2784	952				

Analysis shows that there is no significant difference in left or right extraction forces at either temperature (tests at 0.01 confidence level). There is some dependence on temperature indicated on the right extractor for which no explanation can be given. In general, extraction forces are much lower than those measured during the brass case tests. For example, average extraction forces in the order of 3500 to 5000 lbs. were obtained during accuracy tests of brass-cased U.S.-made ammunition. Equivalent values were measured in other TECHEVAL tests.

Conclusions:

- a. Steel cased 76mm ammunition experiences no structural problems when fired at nominal service conditions and at temperature extremes.
- b. Extraction forces measured with the steel cartridge case are consistent, and are lower than those measured on the brass cartridge case.





Conditioning Temperature (OF)

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Chamber Pressure (Long TSI (Cu))

APPENDIX D

76MM STEEL CARTRIDGE CASE EVALJATION

Rapid Fire (Service Pressure) Test

Objective: Determine structural ability of a steel cartridg, case and its compatibility with the MARK 75 mount in the rapid fire mode.

Test Description: One hundred steel cartridge cases were loaded with 5.30 pounds of M6/2 76mm propellant from lot RAD-E33. Complete BL&P cartridges were then assembled in accordance with NWL Dwg. 40997 using inert projectiles from a lot manufactured for IOT&E tests aboard PHM-1. The 5.30 pound charge weight had been previously established (Appendix B) to provide nominal service velocity and pressure. Twenty cartridges, conditioned to 90°F, were fired (at a firing rate of 80 rounds/minute) from the MARK 75 MOD 0 mount at a vertical plywood target located 500 yards from the gun muzzle. The gun mount was instrumented to measure left and right cartridge case extraction forces, and projectile ejection time. Coils along the line of fire were used to obtain the velocity of each projectile. A 16mm photosonic camera recorded the order of impact of each projectile on the target board.

The remaining 80 cartridges were fired as four 20-round bursts from the MARK 75 MOD 0 mount. The barrel/liner was elevated to a quadrant elevation of 15° for each burst, and range and drift of each projectile impact on the water was measured using phototriangulation techniques (four 70mm photosonic cameras and two 5-inch format Bowen cameras located at various range stations near the point of impact). As before, the gun mount was instrumented to measure left and right cartridge case extraction forces, and projectile ejection time. Coils along the line of flight were used to measure projectile velocity.

Deviations: Two deviations occurred from the test plan of reference 9. First, instrumentation was added to the test to allow measurement of extraction forces, and projectile range and drift information. Second, to allow comparison of the range information with existing range data, the conditioning temperature was changed from ambient to 90°F. It is noted that the vertical target test and the obtaining of range information were piggybacked tests to obtain accuracy data. These data will be discussed in an upcoming 76mm accuracy report and will not be discussed in this report.

Test Results: All cartridges functioned successfully in the rapid fire mode of the MARK 75 mount. One cartridge case was found to have developed a longitudinal split near the base of the case (see Figure D-1). An investigation by NOS/IH disclosed that the split was caused by the presence of a large inclusion near the surface of the steel which the manufacturer had tried to remove by buffing the surface of the case. This apparently weakened the case material sufficiently to allow splitting upon firing. It is noted that all steel cartridge cases were examined after firing, and no other instance of splitting was discovered. Velocity and extraction force information is summarized as follows:

			E	xtraction F	orces (1b	s)
	Average	Standard	I	eft	Rig	<u> </u>
Liner No.	Velocity (ft/sec)	Deviation (ft/sec)	Average	Standard Deviation	Average	Standard Deviation
NOSL No. 8	3001	13.8	2374	358	4538	1310
FCA-101 (Burst 1)	2970	13.2	2558	606		
(Burst 2)	2968	12.1	2569	511		
(Burst 3)	2969	10.8	3045	441		
(Burst 4)	2966	7.2				

Velocity is again low in one liner (FCA-101), however, it easily meets requirements of nominal service requirements on the other liner. Both liners were new, FCA-101 having four previous rounds and liner 8 having 16 previous rounds. As noted before (Appendix C), velocity differences as observed here occur in other gun systems and are usually caused by liner-to-liner variations or by day-to-day variations. Since this test was performed on two different days with two different liners, both sources of variation are felt to have caused the observed velocity differences.

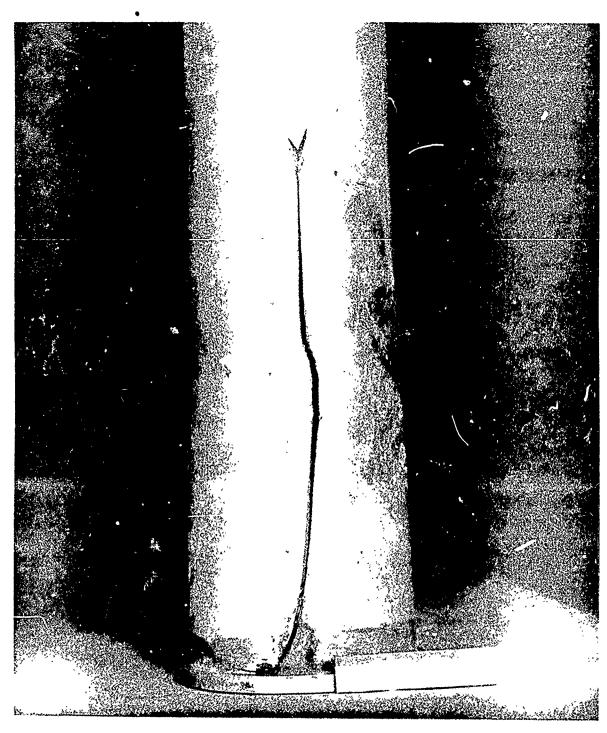
Extraction forces are in general comparable with those reported in Appendix C. No explanation can be given for the atypical high right extraction force reading observed on liner 8. New strain gauges had been installed prior to this test, the gauges from previous tests having been damaged during a barrel change. The observed extraction force is still lower than the minimum extraction force observed on brasscased ammunition.

Strain gauge failure during the firing on liner FCA-101 caused the right extraction data to be either suspect or non-existent. New gauges were installed prior to this test when previously installed gauges were found to be nonfunctional. Initial firings on the new gauges showed the right extractor traces to be extremely erratic, and were not reported. Gauge failure also occurred on the left extractor at the start of the fourth burst fired from liner FCA-101.

Range and dispersion data gathered are shown in Table D-1. Figure D-2 shows a schematic of the target board with impact locations plotted. Analysis of these data will be given in separate reports.

Conclusions:

- a. The steel cartridge case is structurally able to withstand firing at service conditions from the MARK 75 gun mount.
- b. The steel cartridge case is compatible with the MARK 75 gun mount in that forces induced in the mount by firing are equivalent to or lower than those induced by brass-cased ammunition.



PHD-1722-7-75

FIGURE D-1

June 1975

View of longitudinal split in a 76mm steel cartridge case. Split occurred during a rapid fire test from the MARK 75 MOD 0 gup mount.

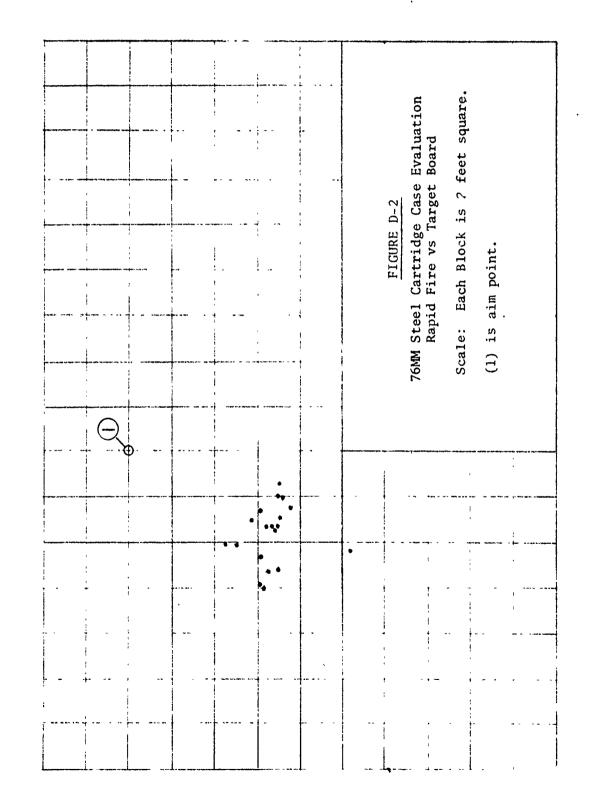


TABLE D-1

76MM STEEL CARTRIDGE CASE EVALUATION

Rapid Fire-Service

Conditioning Temperature 90°F	Mount: MARK 75 MOD 0.	Q.E. 150.

Number No. Number Cft/sec Loft Right (sec) (yds) (yd		Test	Case		Extraction Forces		any . n	Uncorrected	
Liner 8 (S-158) 305 2988 2370 2430 .092									
Liner 8 CS-158	Liner 8	CS-156	139	2962	2310	2590	.082	~~~~	
Liner 8 (S-159 306 2981 2570 2430 .092									
Liner 8 CS-150 306 281 2690 3680 .083									
Liner 8 C5-161 308 5008 2240 4010 .088									
Liner 8 C5-162 304 2999 2280 4010 0.888 Liner 8 C5-162 304 2999 2280 4160 0.866 Liner 8 C5-163 305 2999 2140 4930 1.09 Liner 8 C5-164 302 2998 2500 4160 0.94 Liner 8 C5-165 229 2998 2500 4160 0.93 Liner 8 C5-165 229 2998 2500 4160 0.93 Liner 8 C5-166 232 307 1710 4790 0.98 Liner 8 C5-166 232 307 1710 4790 0.98 Liner 8 C5-168 233 3010 250 6050 0.97 Liner 8 C5-168 233 3010 250 6050 0.97 Liner 8 C5-169 231 3001 2490 6410 1.00 Liner 8 C5-170 236 3010 2750 5650 0.92 Liner 8 C5-171 230 3022 2510 6020 1.06 Liner 8 C5-172 234 3008 2300 5260 1.09 Liner 8 C5-173 233 3014 2100 4870 1.088 Liner 8 C5-174 211 3015 1710 4870 0.90 Liner 8 C5-178 288 3006 1900 5030 0.87 Liner 8 C5-178 288 3066 (2) 0.88 12277 0.90 Liner 8 C5-178 288 3066 (2) 0.88 12277 0.90 Liner 8 C5-178 288 3066 (2) 0.88 12277 0.90 Liner 8 C5-178 288 3066 (2) 0.888 12277 0.90 Liner 8 C5-178 288 3066 (2) 0.898 12277 0.90									
Liner 8 CS-164 305 2999 2140 4930 .109		CS-161	308	3008	2240		.088		
Liner 8 CS-164 302 2998 2550 6440 .094	Liner 8	CS-162	304	2999	2280	4160	.086		
Liner 8 CS-166 229 2998 2930 41660 .093	Liner 8	CS-163	305	2999	2140	4930	.109		
Liner 8 CS-166 232 3007 1710 4790 .098	Liner 8	CS-164	302	2998	2650	6440	.094		• • •
Liner 8 CS-167 207 3004 3020 3160 .966	Liner 8		229	2998	2300	4160	.093		
Liner 8 CS-168 231 3010 2950 6050 .097	Liner 8								
Liner 8 CS-169 231 3001 2490 6410 .100									
Liner 8 (S-17) 250 3010 2750 5650 .092	Liner 8								
Liner 8 CS-171 230 5022 2510 6020 1.06 Liner 8 CS-173 233 5014 2100 4870 1.08 Liner 8 CS-173 233 5014 2100 4870 1.08 Liner 8 CS-173 233 5014 2100 4870 1.08 Liner 8 CS-173 211 3015 1710 4870 0.090 Liner 8 CS-174 211 3015 1710 4870 0.090 Liner 8 CS-175 288 3006 1900 5030 0.087 FCA-101 (1) 3152 3660 (2) 0.081 FCA-101 (1) 2983 2020 (2) 0.990 FCA-101 CS-176 291 2964 3360 (2) 0.088 12265 -24 FCA-101 CS-177 285 2945 2520 (2) 0.088 12265 -24 FCA-101 CS-178 290 2948 1630 (2) 1.011 (2) (2) (2) FCA-101 CS-178 290 2948 1630 (2) 1.011 (2) (2) (2) FCA-101 CS-180 289 2968 1830 (2) 0.097 121258 FCA-101 CS-181 287 2955 1870 (2) 0.094 12352 -21 FCA-101 CS-181 287 2955 1870 (2) 0.094 12352 -21 FCA-101 CS-183 339 2971 1910 (2) 0.096 12128 -20 FCA-101 CS-183 339 2971 1910 (2) 0.096 12128 -20 FCA-101 CS-183 339 2971 1910 (2) 0.096 12128 -20 FCA-101 CS-183 339 2971 2960 2240 (2) 0.089 (2) (2) (2) FCA-101 CS-185 338 2972 2520 (2) 0.097 12090 -18 FCA-101 CS-185 338 2972 2520 (2) 0.097 12090 -18 FCA-101 CS-185 338 204 2967 3520 (2) 0.097 12090 -18 FCA-101 CS-187 341 2967 3520 (2) 0.097 12090 -18 FCA-101 CS-187 341 2967 3520 (2) 0.097 12090 -18 FCA-101 CS-189 345 2966 3170 (2) 0.095 12355 -11 FCA-101 CS-190 343 2987 2740 (2) 0.095 12355 -11 FCA-101 CS-190 343 2987 2740 (2) 0.095 12355 -11 FCA-101 CS-190 343 2987 2740 (2) 0.095 12355 -11 FCA-101 CS-190 343 2987 2740 (2) 0.096 12127 -17 FCA-101 CS-190 343 2987 2740 (2) 0.096 12227 -17 FCA-101 CS-190 343 2987 2740 (2) 0.096 12227 -17 FCA-101 CS-190 343 2987 2740 (2) 0.096 12227 -17 FCA-101 CS-190 343 2987 2740 (2) 0.096 12227 -17 FCA-101 CS-190 343 2987 2940 (2) 0.096 12313 -11 FCA-101 CS-190 343 2987 2940 (2) 0.096 12313 -11 FCA-101 CS-190 343 2987 2940 (2) 0.096 12313 -11 FCA-101 CS-190 343 2987 2940 (2) 0.096 12313 -11 FCA-101 CS-190 343 2987 2940 (2) 0.096 12313 -11 FCA-101 CS-190 343 2940 200 (2) 0									
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10/10/10/10/10/10/10/10/10/10/10/10/10/1									
							.088		

TABLE 0-1 (Cont'd)

76MM STEEL CARTRIDGE CASE EVALUATION

Rapid Fire-Service

Mount: MARK 75 MOD 0. Q.E. 15° Conditioning Temperature 90°F

Number No. Number (Et/sec) Left Right (sec) (yds) (yds) (yds)	Barrel	Test Unit	Case Serial	Velocity	Extract (1b	ion Forces	CFK to Ejection	Uncorrected	D 61
FCA-101 CS-214 251 2970 2300 (2) .096 11929 -49 FCA-101 CS-215 206 2958 1790 (2) .096 11829 -56 FCA-101 CS-216 250 2975 2300 (2) .089 11942 -11 FCA-101 CS-216 316 2944 2400 (2) .089 12256 -6 FCA-101 CS-218 316 2964 2400 (2) .089 12256 -6 FCA-101 CS-218 316 2964 2400 (2) .099 12215 -15 FCA-101 CS-218 316 2964 2400 (2) .099 12215 -15 FCA-101 CS-219 295 2952 2240 (2) .091 11987 -28 FCA-101 CS-210 271 2963 3510 (2) .091 11987 -28 FCA-101 CS-221 259 2972 3250 (2) .100 11287 -28 FCA-101 CS-222 267 2980 3030 (2) .103 12327 4 FCA-101 CS-223 265 2964 3530 (2) .092 11976 -16 FCA-101 CS-225 187 2970 3480 (2) .092 11976 -16 FCA-101 CS-225 187 2970 3480 (2) .098 12282 17 FCA-101 CS-225 187 2970 3480 (2) .098 12282 17 FCA-101 CS-225 187 2970 3480 (2) .099 12014 -34 FCA-101 CS-225 2986 306 306 (2) .098 12282 17 FCA-101 CS-225 187 2970 (2) .099 12014 -34 FCA-101 CS-225 187 2970 (2) .099 12014 -34 FCA-101 CS-225 187 2970 (2) .099 12014 -34 FCA-101 CS-225 187 2978 3430 (2) .099 12014 -34 FCA-101 CS-227 350 2980 360 (2) .099 12014 -34 FCA-101 CS-228 352 2978 3430 (2) .099 12014 -34 FCA-101 CS-229 382 2970 (2) .20 .099 12169 111 FCA-101 CS-230 268 2999 (2) .20 .099 12169 111 FCA-101 CS-230 288 2999 (2) .20 .099 12169 111 FCA-101 CS-231 281 2980 (2) .20 .099 12169 111 FCA-101 CS-235 280 2955 (2) .20 .099 12169 .11 FCA-101 CS-235 290 2981 (2) .20 .099 11916 -7 FCA-101 CS-235 290 2981 (2) .20 .099 11916 -7 FCA-101 CS-235 290 2988 (2) .20 .099 11916 -7 FCA-101 CS-235 290 2988 (2) .20 .099 11916 -7 FCA-101 CS-235 290 2988 (2) .20 .099 11916 -7 FCA-101 CS-235 290 2988 (2) .20 .099 11916 -7 FCA-101 CS-235 290 2988 2950 (2) .20 .099 11916 -7 FCA-101 CS-235 290 2981 (2) .20 .099 11916 -7 FCA-101 CS-235 290 2988 2950 (2) .20 .099 11916 -7 FCA-101 CS-235 290 2988 200 2975 (2) .099 11916 -7 FCA-101 CS-235 290 2988 2968 20 .20 .099 11919 -9 FCA-101 CS-248 221 2970 (2) .099 11916 -7 FCA-101 CS-248 221 2990 (2) .099 11919 -9 FCA-101 CS-248 221 2990 2965 (2) .099 11995 1189 -9 FCA-101 CS-248 221 2997 2965 (2) .099 11995 11999 -9 FCA-101 CS-248 22						•		Range (yds)	Deflection (yds)
FCA-101 CS-215 206 2958 1790 (2)					2970	(2)	.100		(2)
FCA-101 CS-216 250 2975 2300 (2) 0.889 11942 -11 FCA-101 CS-217 310 2947 2970 (2) 0.899 12256 -6 FCA-101 CS-218 316 2964 2400 (2) 0.999 12239 -6 FCA-101 CS-219 269 2952 2240 (2) 0.993 12215 -15 FCA-101 CS-219 269 2952 2240 (2) 0.993 12215 -15 FCA-101 CS-212 259 2972 3250 (2) 1.00 12322 4 FCA-101 CS-221 259 2972 3250 (2) 1.00 12322 4 FCA-101 CS-222 267 2980 3030 (2) 1.03 12327 4 FCA-101 CS-223 265 2964 3330 (2) 0.992 12084 4 FCA-101 CS-223 265 2964 3330 (2) 0.992 12084 4 FCA-101 CS-225 187 2970 3480 (2) 0.992 11976 -16 FCA-101 CS-225 187 2970 3480 (2) 0.998 12282 17 FCA-101 CS-225 329 2986 3290 (2) 0.998 12282 17 FCA-101 CS-228 322 2978 3430 (2) 0.999 12014 -34 FCA-101 CS-228 322 2978 3430 (2) 0.999 12014 -34 FCA-101 CS-228 332 2978 3430 (2) 0.999 12014 -34 FCA-101 CS-228 332 2978 3430 (2) 0.999 (2) (2) (2) FCA-101 CS-228 332 2978 3430 (2) 0.999 (2) (2) FCA-101 CS-228 332 2978 3430 (2) 0.999 (2) (2) FCA-101 CS-228 332 2978 3430 (2) 0.999 (2) (2) FCA-101 CS-228 332 2978 3430 (2) 0.999 (2) (2) FCA-101 CS-230 268 2969 (2) (2) 0.999 (2) (2) FCA-101 CS-231 281 2980 (2) (2) 0.999 (2) (2) FCA-101 CS-232 200 2951 (2) (2) 0.999 12169 11 FCA-101 CS-233 280 2975 (2) (2) 0.99 12169 11 FCA-101 CS-233 280 2975 (2) (2) 0.99 12169 11 FCA-101 CS-233 280 2975 (2) (2) 0.99 12169 11 FCA-101 CS-234 220 2881 (2) (2) 0.99 12169 11 FCA-101 CS-235 277 2969 (2) (2) 0.99 12169 12169 11 FCA-101 CS-237 249 2958 (2) (2) 0.99 12060 2 FCA-101 CS-238 253 2953 (2) (2) 0.99 12060 2 FCA-101 CS-237 249 2958 (2) (2) 0.99 12060 2 FCA-101 CS-243 328 2965 (2) (2) 0.99 12060 2 FCA-101 CS-244 334 2965 (2) (2) 0.99 12060 2 FCA-101 CS-244 334 2965 (2) (2) 0.99 12060 2 FCA-101 CS-244 334 2965 (2) (2) 0.99 12060 2 FCA-101 CS-244 334 2965 (2) (2) 0.99 12060 2 FCA-101 CS-243 328 2977 (2) (2) 0.99 12060 2 FCA-101 CS-244 334 2965 (2) (2) 0.99 12060 2 FCA-101 CS-243 328 2977 (2) (2) 0.99 12060 2 FCA-101 CS-244 334 2965 (2) (2) 0.99 12060 12142 -3 FCA-101 CS-245 257 2978 (2) (2) 0.99 12060 12060 2 FCA-101 CS-248 221 2957 (2) (2) 0.99 12060 12060 2 FCA-101 CS-248 2						(2)	.096	11929	
FCA-101 CS-217 310 2947 2970 (2) 0.899 12255 -6 FCA-101 CS-218 316 2964 2400 (2) 0.993 12239 -6 FCA-101 CS-219 269 2952 2240 (2) 0.993 12239 -6 FCA-101 CS-220 271 2963 3310 (2) 0.991 11987 -2.8 FCA-101 CS-220 271 2963 3310 (2) 0.991 11987 -2.8 FCA-101 CS-222 267 2980 3030 (2) 1.100 12322 4 FCA-101 CS-222 267 2980 3030 (2) 1.103 12327 4 FCA-101 CS-222 267 2980 3030 (2) 1.03 12327 4 FCA-101 CS-222 267 2980 3030 (2) 1.092 12084 4 FCA-101 CS-224 266 2960 3200 (2) 0.992 11976 -16 FCA-101 CS-225 187 2970 3480 (2) 0.998 12282 17 FCA-101 CS-225 187 2970 3480 (2) 0.998 12282 17 FCA-101 CS-226 329 2986 3290 (3) 0.999 12014 -34 FCA-101 CS-227 350 2980 3360 (2) 0.966 12386 -11 FCA-101 CS-228 329 2978 3430 (2) 1.02 12092 -28 FCA-101 CS-229 782 2970 (2) (2) 0.999 (2) (2) (2) FCA-101 CS-229 782 2970 (2) (2) 0.999 (2) (2) (2) FCA-101 CS-231 281 2980 (2) (2) 0.999 12169 11 FCA-101 CS-233 280 2958 (2) (2) 0.999 12169 11 FCA-101 CS-233 280 2951 (2) (2) 0.999 12169 11 FCA-101 CS-233 280 2951 (2) (2) 0.999 12169 11 FCA-101 CS-234 200 2951 (2) (2) 0.999 12169 11 FCA-101 CS-234 200 2951 (2) (2) 0.999 11916 -7 FCA-101 CS-234 200 2951 (2) (2) 0.999 11916 -7 FCA-101 CS-235 280 2956 (2) (2) 0.999 11916 -7 FCA-101 CS-234 200 2951 (2) (2) 0.999 1204 11 FCA-101 CS-234 200 2951 (2) (2) 0.999 1204 11 FCA-101 CS-234 200 2951 (2) (2) 0.999 11916 -7 FCA-101 CS-235 280 2956 (2) (2) 0.999 11916 -7 FCA-101 CS-234 200 2951 (2) (2) 0.999 11916 -7 FCA-101 CS-234 200 2951 (2) (2) 0.999 11916 -7 FCA-101 CS-234 200 2951 (2) (2) 0.999 1209 1209 1209 1209 1209 1209 1209 1						(2)	.096	11829	-56
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⁽¹⁾ Spotting cartridges (round 1 Italian depot round, round 2 steel-cased cartridge (5.30 lb charge weight)).(2) Data suspect; not recorded.

APPENDIX E

REFERENCES

- 1. Technical Evaluation of 76mm/62 (OTO Melara) MARK 75 MOD 0 Mount; NWL Technical Report TR-2996 of August 1973 (Unclassified).
- Limited Technical Evaluation of 76mm/62 Gun Mount MARK 75 MOD 1;
 NSWC/DL Technical Report TR-3281 of April 1975 (Unclassified).
- 3. Technical Evaluation of 76mm/62 Caliber Ammunition for the MARK 75

 Gun Mount; NSWC/DL Technical Report TR-3355, Publication Pending

 (Confidential).
- 4. 76mm/62 Caliber Ammunition Safety Evaluation Report; NSWC/DL Technical Report TR-3256 of April 1975 (Unclassified).
- 5. 76mm/62 Caliber Ammunition Reliability Assessment Report; NSWC/DL Technical Report, Publication Pending (Unclassified).
- 6. 76mm/62 Caliber Ammunition Engineering Evaluation Report; NSWC/DL Technical Report, Publication Pending (Confidential).
- 7. MARK 75 MOD 0 Gun Malfunction Report; NSWC/DL Technical Report, Publication Pending (Confidential)
- 8. 76mm/62 Caliber Accuracy Assessment; NSWC/DL Technical Report TR-3278, Publication Pending (Unclassified).
- 9. NOS/IH Memo 5032T:JOR 8032/1 of 21 Jan 1975.
- 10. NAVSURFWPNCEN/DL Memo DT-41:RCR:ges 8010/1-21 of 10 Sep 1975.

APPENDIX F

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9. PERFORMING ORGANIZATION NAME AND ADDRESS	0. PROGRAM ELEMENT, PROJECT, TASK
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76mm MARK 75 Gun Mount	Single Fire Service Test
Structural Overtests	Rapid Fire Service Test
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20. ABSTRACT (Continued)

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The state of the s

cartridge case out of 205 cases tested was found to have failed structurally upon firing. After examination of the cartridge case by the Naval Ordnance Station/Indian Head, Maryland, it was determined that the cause of the failure was the presence of a manufacturing defect in the case wall. As a result of the test program and analysis conducted, it is concluded that the steel cartridge case is a suitable replacement for the 76mm brass cartridge with respect to structural integrity and compatibility with the MARK 75 gun mount.

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